In the Claims:

Following is a complete list of the claims, as amended:

1-15.   (Cancelled).

16.   (Currently Amended) A method of characterizing spectral emission features of a sample material, over a selected frequency range R, comprising:

selecting S/n samples from a time-domain signal and performing a Fast Fourier Transform (FFT) on the samples to produce an FFT signal, wherein F is a sampling rate for sampling the time-domain signal, where ~~F* T~~ F times T is a total sample count S, F is greater than a frequency domain resolution f of the FFT of the time-domain signal sampled at the sampling rate F, and ~~S>f * n~~S is greater than f times n, where n is at least 5;

calculating an average power for the FFT signal,

placing an event count in each of f selected-frequency event bins where the measured power at the corresponding selected <u>frequency is greater than a magnitude or average</u> ~~frequency > average~~ power ~~*~~ <u>multiplied by</u> ε, where 0< ε<1 and is chosen such that the total number of counts placed in an event bin is between about 20-50% of maximum possible bin counts in that bin; and

generating a display that shows, for each event bin f over a selected frequency range, a number of event counts in each bin.

17.   (Original) The method of claim 16, which further includes normalizing the FFT signal before calculating the average power, placing the normalized power value from the FFT in f corresponding-frequency power bins, dividing accumulated values placed in each of the f power bins by n to yield an average power in each bin, and displaying on a histogram the average power in each bin.

18.   (Original) The method of claim 17, which further includes identifying those bins in the histogram that have an event count above a given threshold and an average power.

19.   (Original) The method of claim 18, wherein R, expressed in Hz, is approximately equal to f, and the sample rate F, expressed in samples/second, is approximately 2f.

20.   (Original) The method of claim 19, wherein the method detects low-frequency emission events related to molecular emissions in a sample, and wherein R includes at least the frequency range of 100 Hz to 5 kHz.

21-41. (Cancelled).

42.   (New) The method of claim 16, further comprising normalizing the FFT signal before calculating the average power, and wherein the FFT is a Real Fast Fourier Transform.

43.   (New) The method of claim 16, further comprising, before selecting, storing a time-domain signal of the sample over a sample-duration time T;

44.   (New) The method of claim 16, further comprising repeating the selecting, calculating and placing, before generating the display.

45.   (New) A computer-readable medium whose contents cause at least one data processing device to perform a method to display data representing an electromagnetic signal from a sample, the method comprising:

receiving a sample signal that has been produced by applying a generated stimulus signal to a sample within an electromagnetically shielded detection apparatus in the absence of another generated signal from another signal source, wherein a combination of the stimulus signal with

an electromagnetic signal emitted by the sample takes on a different characteristic than the stimulus signal through stochastic resonance, and wherein the electromagnetically shielded detection apparatus includes therein a Super Conducting Quantum Interference Device electrically connected to at least one electromagnetic emission detection coil,

wherein the sample acts as a signal source for molecular signals, and wherein the electromagnetically shielded detection apparatus includes a cryogenic container and magnetic shielding external to the cryogenic container, wherein the stimulus signal is applied to the sample within in the absence of another generated signal from another signal source, and wherein the sample is not ionized or damaged during the receiving of the sample signal;

processing the sample signal to analyze characteristics of the stochastic resonance; and

outputting the sample signal, wherein the sample signal is represented as a series of peaks at select frequencies, wherein the peaks are substantially greater than other peaks in the sample signal, and wherein at least some of the other peaks represent the stimulus signal.

46.   (New) The computer-readable medium of claim 45, wherein the outputting includes displaying, via a graphical user interface, the sample signal, wherein the sample signal is displayed as a series of peaks at the select frequencies.

47.   (New) The computer-readable medium of claim 45, wherein the processing of the sample signal includes applying a Fast Fourier Transform to the sample signal.

48.   (New) The computer-readable medium of claim 45, wherein the processing of the sample signal includes applying a linear mathematical process to the sample signal.

49.   (New) A low-frequency spectral signal associated with a sample of a material of interest comprising:

a list of frequency components in the DC-50KHz frequency range that are generated by a method comprising:

placing the sample in a cryogenic container having both magnetic and electromagnetic shielding, wherein the electromagnetic and magnetic shielding are external to the cryogenic container;

applying a generated stimulus signal to the sample;

recording an electromagnetic time-domain signal composed of a sample source signal superimposed on the applied stimulus signal, wherein the sample acts as a signal source for molecular signals, wherein the stimulus signal is applied to the sample within in the absence of another generated signal from another signal source, and wherein the sample is not ionized or damaged during the recording of the signal;

comparing the time-domain signal recorded with a second time domain signal separately recorded from the same or similar sample, to produce a frequency domain spectrum in a frequency range within DC to 50Khz; and

identifying in the frequency-domain spectrum, one or more low-frequency signal components that are characteristic of the material, wherein the low-frequency signal components are below 50Khz.

50.   (New) The signal of claim 49, wherein the frequencies in the list are identified from signal components whose amplitudes have a selected statistical measure above background spectral noise.

51.   (New) The signal of claim 49, wherein the applying includes generating noise from a noise generator and injecting the noise into the sample via a Helmholz coil which is located within the container.

52.   (New) The signal of claim 49, wherein the applying includes injecting stationary white Gaussian noise into the sample, at an amplitude sufficient to produce non-stationary composite signal components.

53.   (New) The signal of claim 49, wherein the stimulus signal applied to the sample has a frequency between DC and 2 KHz.

54.   (New) The signal of claim 49, wherein the detecting includes capturing the composite signal with a first-derivative superconducting gradiometer and converting the gradiometer signal to an amplified voltage signal by a SQUID.

55.   (New) The signal of claim 49, which further includes transforming a cross-correlated frequency-domain spectrum to produce a frequency-domain spectral plot in a range between 100 and 42,200 Hz.

56.   (New) The signal of claim 49, for use in characterizing a known sample material according to frequencies of its low-frequency signal components, which further includes identifying frequencies of sample-specific spectral components (i) in a selected frequency range between DC and 50KHz (ii) whose cross-spectral correlations have a selected statistical measure above background spectral noise.

57.   (New) An apparatus for detecting molecular signals from a sample, the apparatus comprising:

    means for detecting electromagnetic emission signals positioned near to the sample;

    a Super Conducting Quantum Interference Device electrically connected to the electromagnetic emission detection coil, wherein the Super Conducting Quantum Interference Device is positioned within a means for cryogenically cooling;

means for surrounding the sample with a stimulus signal and the means for detecting signals, wherein the stimulus signal has a substantially uniform amplitude over multiple frequencies;

means for electromagnetically shielding at least a portion of the sample, the electromagnetic emission detection coil, the Super Conducting Quantum Interference Device, and the means for surrounding, from external electromagnetic radiation, and wherein the means for electromagnetically shielding is positioned exterior to the means for cryogenically cooling;

means for controlling the Super Conducting Quantum Interference Device; and

means for providing observations regarding the signal detected by the means for detecting.

58.   (New) The apparatus of claim 57, wherein the means for surrounding includes two elements pivotable with respect to each other.

59.   (New) The apparatus of claim 57 wherein the means for detecting electromagnetic emissions includes a second derivative gradiometer.

60.   (New) The apparatus of claim 57 wherein the means for surrounding includes means for generating white noise as the stimulus signal.